BOOKS & ARTS

Final warning from a sceptical prophet

In his new book, James Lovelock fears that humanity faces widespread death and mass migration as Earth's systems become further unbalanced by climate change, explains **Andrew Watson**.

In James Lovelock's early books, the face of Gaia is one of beauty. Whether or not he meant it that way, many readers saw Gaia not just as a metaphor for the self-regulating Earth system of Lovelock's theory, but as a wise and bountiful goddess guiding Earth to keep conditions comfortable for life. Originally writing that the system sought an "optimum" state, in hindsight, he says he wishes he'd avoided that loaded word because it stoked the fury of critics who accused him of promoting pseudoscience.

Late Gaia, by contrast, is barely recognizable as the same deity. In his new book, *The Vanishing Face Of Gaia*, as in his previous *The Revenge of Gaia* (Allen Lane, 2006), she is old, vengeful and dangerous — Medusa, perhaps, rather than Ceres. And her anger is directed at us, the plague of apes who have appropriated Earth's resources to satisfy our endless greed.

Lovelock writes wonderfully well. With the authority of age — he is in his ninetieth year — his voice is that of an elder statesman. Using a wider and older vocabulary than most writers today, he sets his reference points deep in mid-twentieth-century Britain. The result is mellifluous and fluent, reminiscent of the rounded vowels of an earlier generation of radio announcers, while his message is arresting and disturbing. It is like listening to the BBC announcing the end of the world.

In their authorized biography of Lovelock, writers John and Mary Gribbin give chapter and verse on the remarkable career of this largely self-made scientist. *He Knew he was Right* (US title *James Lovelock: In Search of Gaia*) has a more conventional tone than Lovelock's own writing. It is a good read about an eventful life, but there is little here that cannot be found in Lovelock's autobiography *Homage to Gaia* (Oxford University Press, 2000). The Gribbins' book is useful — it puts Lovelock's work in the context of other pioneers of what is now known as Earth-systems science, including the geochemist Vladimir Vernadsky and environmentalist Rachel Carson. However, the science is not up-to-date in some important aspects, which is a missed opportunity.

T. CUFF/ALAMY

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In *The Vanishing Face Of Gaia*, Lovelock argues that model projections of the climate a century ahead are of little use. The models of the Intergovernmental Panel on Climate Change (IPCC) extrapolate from a smooth trend of warming, yet the real climate system, complex and fully coupled to the biology of land and ocean, is unlikely to change in this simple way. It is more likely to flip from one state to another, with non-linear tipping points that the IPCC models are too simplistic to capture. Lovelock fears that the climate will shift to a new and considerably hotter regime, and that once underway, this shift will be irreversible.

This view is not officially sanctioned 'IPCC-speak', but he is fully within the envelope of scientific consensus when he warns of the possibility of rapid and irreversible change. Other climate scientists — notably Wally Broecker (see *Nature* 328, 123–126; 1987) — have said much the same for a long time, although Lovelock uses more graphic language and his popular voice will carry further. Palaeoclimate records

show that rapid flips have happened before, so this must be a strong possibility for the future if we continue to force up the levels of greenhouse gases at the current rate.

What is controversial is Lovelock's vision for humanity: rapid climate change will lead to the deaths of most people on the planet, and to mass migrations to those places that are still habitable. He does not spell out exactly how this might happen, but is convinced a hotter Earth will be able to sustain only a few per cent of the current human population. The implication is that Gaia and human society are close to a cliff-edge, and could unravel rapidly and catastrophically.

The controversy lies less in the climatology and more in the sociology. How will societies behave in the face of such change? Will we pull together with a wartime spirit, or will we fragment, fight and kill one another over Gaia's carcass? Lovelock is on softer ground here. His only special qualification for discussing human behaviour is his longevity — having lived through the Second World War, he knows what people sometimes do to one another during evil times.

Lovelock's vision of sudden and imminent collapse is apocalyptic, but for our long-term future and that of the planet it might be preferable to some of the alternatives. Suppose, for instance, that our profligate ways and expanding

The Vanishing Face of Gaia: A Final Warning
by James Lovelock
Allen Lane/Basic Books: 2009.
192 pp./ 288 pp. £20/\$25

He Knew He Was Right: The Irrepressible Life of James Lovelock and Gaia
by John Gribbin and Mary Gribbin
Allen Lane/Princeton University Press:
2009. 256 pp/272 pp. £20/\$24.95

population are sustained for the rest of this century, but at a huge cost — the complete loss of all the natural ecosystems of the world. Most of us, living in cities and insulated from the natural environment, would barely notice until it was too late to do anything about it. This is what many politicians, economists and industrialists seem to want — their mantra of unceasing economic growth implies that we should take for ourselves all Gaia's resources and squeeze from them the maximum short-term gain, leaving nothing for the future.

Following this vision, we will need to transform the entire planet into a factory farm to feed our 10 billion or 15 billion mouths. There will be no room on this giant spherical feedlot for anything but ourselves and our half-dozen species of domestic plants and animals. Gaia, the natural Earth system, will have disappeared. As for the underpinning biogeochemical cycles,

the best we can hope is that we can manage them ourselves, taking over the heavy responsibility for keeping Earth habitable, which Gaia once did for us automatically.

The more likely outcome is that we would barely manage them at all. In that case, we would face a sequence of global environmental crises and a steady degradation of the planetary environment that would eventually kill just as many of us as a sudden collapse. Given that, perhaps we had better hope that Lovelock is right, and Gaia does for us — or most of us — before we do for her. ■

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Watch Oliver Morton's interview with James Lovelock at www.nature.com/nature/videoarchive.

Pursuing the infinite

Naming Infinity: A True Story of Religious Mysticism and Mathematical Creativity

by Loren Graham and Jean-Michel Kantor
Belknap/Harvard University Press: 2009.
256 pp. \$25.95, £19.95

Religious mystics have a long history of borrowing from mathematics. It is less common for mathematicians to draw on religion. In *Naming Infinity*, historian of science Loren Graham and mathematician Jean-Michel Kantor argue that an esoteric Christian sect contributed to advances in set theory in Russia in the first decades of the twentieth century. In pursuing their claim, they reveal a much larger drama: the flourishing of mathematics under the repression of the early Soviet regime.

Graham and Kantor begin in 1913, when the Imperial Russian Navy stormed a monastery on a Greek peninsula where a sect of Russian Orthodox monks had fled to pursue a mystical practice known as name worshipping. Holding the heretical view that God comes into existence when named, these monks believed that repeating the name of Jesus while controlling their breath and heartbeat would bring them closer to the infinite. Their persecution at the hands of the Tsar in the ensuing years aroused the sympathy of

a number of Russian intellectuals. Among them was a handful of mathematicians in Moscow who, working in the young field of set theory, also found themselves dealing with the infinite.

These Russian mathematicians had been racing their French colleagues to take the measure of infinite sets of real numbers. In 1891 the German mathematician Georg Cantor made a crucial advance when he proved

that some infinite sets were larger than others. A group of French mathematicians at the turn of the century — including Emile Borel, Henri Lebesgue and René Baire — were searching for a systematic way to determine the size of these infinite sets. This aroused the scepticism of colleagues such as Henri Poincaré, who claimed that Cantor's hierarchy of infinities had “a whiff of form without matter, which is repugnant to the French spirit”. According to the authors, the French researchers found themselves at the edge of an “intellectual abyss” where, “under the influence of their ultra-rationalistic traditions, they lost their nerve” and abandoned their work.

The situation was different in Moscow, where the Russian mathematicians took up the same problems with zeal and eventually resolved them, advancing the far-reaching field of measure theory and launching descriptive set theory. Graham and Kantor argue that the spiritual views of these mathematicians were crucial to their scholarly work. That there were ties between some of the mathematicians and the heretical sect is not in doubt. The geometer Dmitri Egorov believed in name worshipping. His student Pavel Florensky, a mathematician turned theologian, held that the ‘set of all sets’ might be God himself. The eminent mathematician Nikolai Luzin was privately sympathetic to the sect.

None of this illuminates a substantive connection between the ideas of the monks and the mathematicians. These Russian scholars did push forward where the French would not, so it is reasonable to ask whether their religion gave them an edge: did their belief that both God and sets could be named into existence help them deal more creatively with the infinite? The authors do not settle this question, and never fully explain why the work of the Russians should have required a belief in name worshipping as opposed to another spiritual belief. In the end, they backpedal to say they are “not claiming a unique or necessary relationship” between mysticism and mathematics but are merely saying that the heresy of name worshipping “played a role in their conceptions”. They don't, however, say what that role was.

Whatever their ties, the mathematicians and the heretics suffered similar fates under the Soviet regime. For a time both escaped the worst treatment. The name-worshippers hid in the shadows as Vladimir Lenin went after the mainstream Orthodox church. Mathematicians survived longer than other academics because, unlike physicists or chemists, they did not need special equipment, and unlike historians or philosophers,

Secret-police archives document the execution of mathematician Pavel Florensky by the Soviet regime.